Atmospheric Photochemistry Studies of Pollutant Emissions from Transportation Vehicles Operating on Alternative Fuels

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Subcontract Number

XAP-3-11153-01

Performance Period

9/93–9/95

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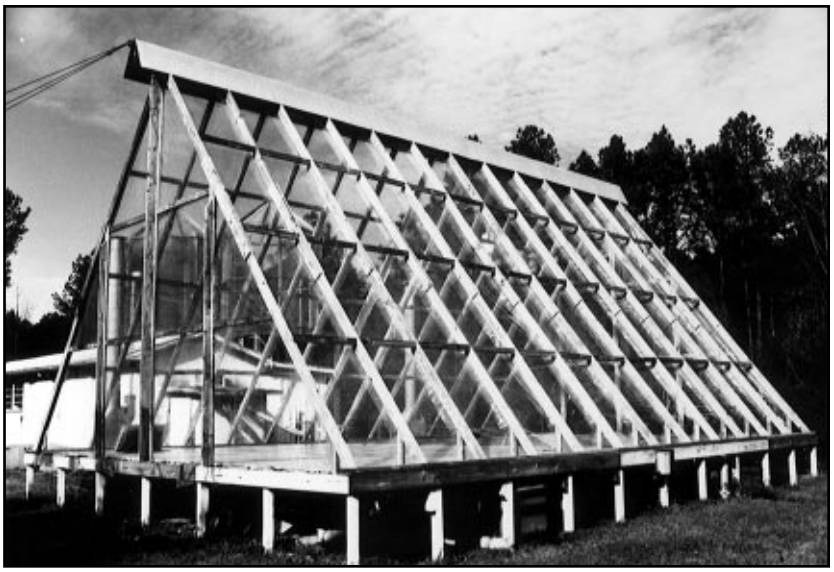
Objective

To improve our ability to predict the changes in urban ozone (O_3) that result from the widespread use of alternative fuels in automobiles. The entire range of fuels—alcohol fuels, natural gas fuels, and reformulated gasoline (RFG)—is of interest.



The University of North Carolina outdoor smog chamber

Approach

The smog chamber is a chemical environment designed to simulate the complex volatile organic compound (VOC) compositions of urban atmospheres. We conducted outdoor smog chamber experiments using complex VOC mixtures that arise from the use of blended ethanol (EtOH), compressed natural gas (CNG), and liquefied petroleum gas (LPG) as vehicle fuels. Advanced analytical methods are used to identify and quantify previously unknown or undetected reaction products. These results will then be used to test and improve the formulations of our current photochemical reaction mechanisms, and with Urban Airshed Model (UAM) simulations, to help answer questions concerning the effect of urban O_3 from the use of alternative fuels.

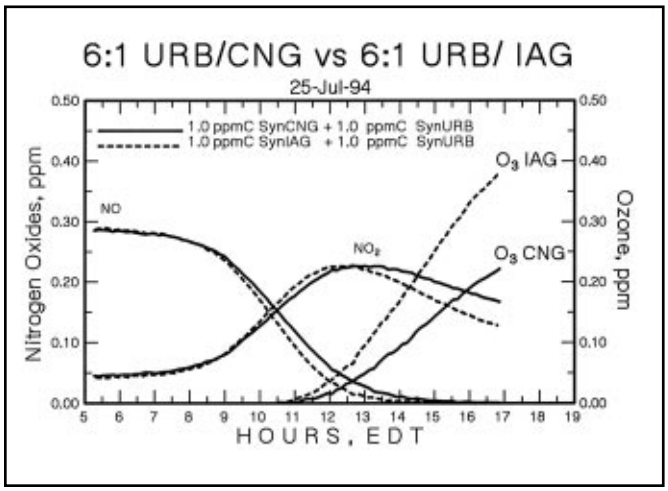
Accomplishments

Twenty-five smog chamber experiments were conducted for this study. Although we are continuing to process the data from these experiments, our preliminary results indicate a substantial benefit from the use of CNG and LPG in a synthetic urban air mixture (SynURB) background.

Future Direction

Final data processing of the experiments will be the major effort of Phase 1.

In Phase 2, we will reformulate a commonly used airshed reaction mechanism to fit more accurately the chamber observations and will use this improved mechanism in UAM simulations of air quality under alternative fuel use scenarios.



Smog chamber results comparing ozone (O_3) formation from natural gas and from Industry Average Gasoline (IAG)

Publications

Borbridge, L. 1995. "A Dual Derivatization Technique for the Determination of Unsaturated and Epoxy-Carbonyls in Air Using Gas Chromatography/Mass Spectrometry." University of North Carolina, August.

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Jang, J.C.C.; H.E. Jeffries; D. Byun; J.E. Pleim. 1995. "Sensitivity of Ozone to Model Grid Resolution, Part II," *Atmospheric Environment*, in press.

Lo, C.Y.S. 1995. "Process Composition Analysis of Urban Airshed Model Predictions." University of North Carolina. August.

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